THE POLITICAL ECONOMY OF RIVER RATS AND IDAHO'S FOUR RIVERS WHITEWATER RAFTING LOTTERY

By
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Introduction

Idaho is known as the *Whitewater State*. It includes thousands of miles of navigable whitewater, ranging from steep creeks to big rivers with huge rapids. Some of the big rivers have become especially well-known and rafting on four of the most popular stretches of these rivers is regulated during peak season by the U.S. Forest Service via the Four Rivers Lottery. To raft these river sections during the peak season, rafters must submit an application for a permit, and the permits are then allocated by computer lottery for the upcoming rafting season.

There are at least 12 stretches of rivers in the west, for which rafting permits are distributed in this way, and most western states hold lotteries to allocate permits for hunting one or more big game species (Buschena, Anderson, and Leonard, Loomis 1982, Nickerson). Lotteries come in many forms, but they are not the only way of allocating rights for natural resource use. Noncommercial permits to raft the Grand Canyon of the Colorado River are allocated by a waiting list, although as of December 2003 the National Park Service placed a hold on adding names to the 8,000+ waiting list, and are considering alternative allocation schemes (Grand Canyon National Park).[2] Rationing permits strictly by price is an alternative that tends to be good at getting permits to the right people, but it is rarely used as the primary distribution mechanism for these types of resources, often because of protest about the inequity associated with a pricing system (Sandrey, Buccola, and Brown, Loomis 1980). Those with higher incomes are more likely to obtain the permits, and this is in conflict with the idea that everyone should have equal access to natural resources.

As is usually the case with lotteries for the use of natural resources, once the permits are allocated by the Four Rivers Lottery they are not transferable; the permit holder must be on the raft trip for the permit to be valid. This restriction is enforced, too; a Forest Service official verifies the permit holder's identity at the river put-in site, and Forest Service officials may review permits at any point along the river. Financial penalties are issued for rafters without a valid permit.[3] Standard economic logic suggests that allowing permit trading, even after the permits have been allocated by lottery, would increase welfare among rafters by allowing those who value rafting trips most highly to buy a permit from lottery winners who care less about rafting. In this article, we examine why this market restriction might have been imposed, and whether it should be.

In the next section, we begin by examining some of the important characteristics of the rafting environment and the current Four Rivers permit allocation system. We then hypothesize why the Forest Service imposes this market restriction. Next, we informally compare the expected value to

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[2] In contrast, Loomis 1980 reports that in 1976 there were 425 applications for 36 permits to float the Grand Canyon, which were at that time apparently allocated by lottery. Demand for white water rafting has exploded since then.
[3] On the other hand, enforcement is undoubtedly not perfect, and there are other ways of buying your way onto the river. It may take nothing but some spare time at the put-in and a few cases of beer for a non-permit holder to sneak on with a permitted rafting party.

rafters of the permits with and without a post-lottery permit market. We conclude with a discussion about the efficacy of prohibiting a secondary permit market.

Rafting Permits and the Allocation Process

The Middle Fork of the Salmon, the Main Fork of the Salmon, the Upper Selway, and Hells Canyon of the Snake River are all situated in the mid-section of Idaho (Figure 1). A permit is required to float these stretches during the most popular times of year, roughly between early June and late July, which coincides with high water periods for each river. These river stretches provide some of the most desirable multi-day river trips in the world, with big sandy beaches for camping, excellent fishing, and beautiful scenery. The early season provides big, fast, and challenging whitewater for adrenaline junkies, and the late season provides a more relaxing, sunny, warm float, with milder rapids and crystal-clear water for the more laid-back crowd. Rafters highly value these rivers for recreation. Consumer surplus estimates calculated in 1969 by Michalson for recreation on the Middle Fork of the Salmon average approximately $385 per day or to just over $2300 for a six-day trip when inflated to 2003 dollars. This compares to a six-day commercially run raft trip on the Middle fork of the Salmon, which costs approximately $1,500 or more per person, depending on the outfitter.[4] This amount does not include the costs of getting to the rivers (which, by the way, can be quite an excursion in itself) or the opportunity cost of time.

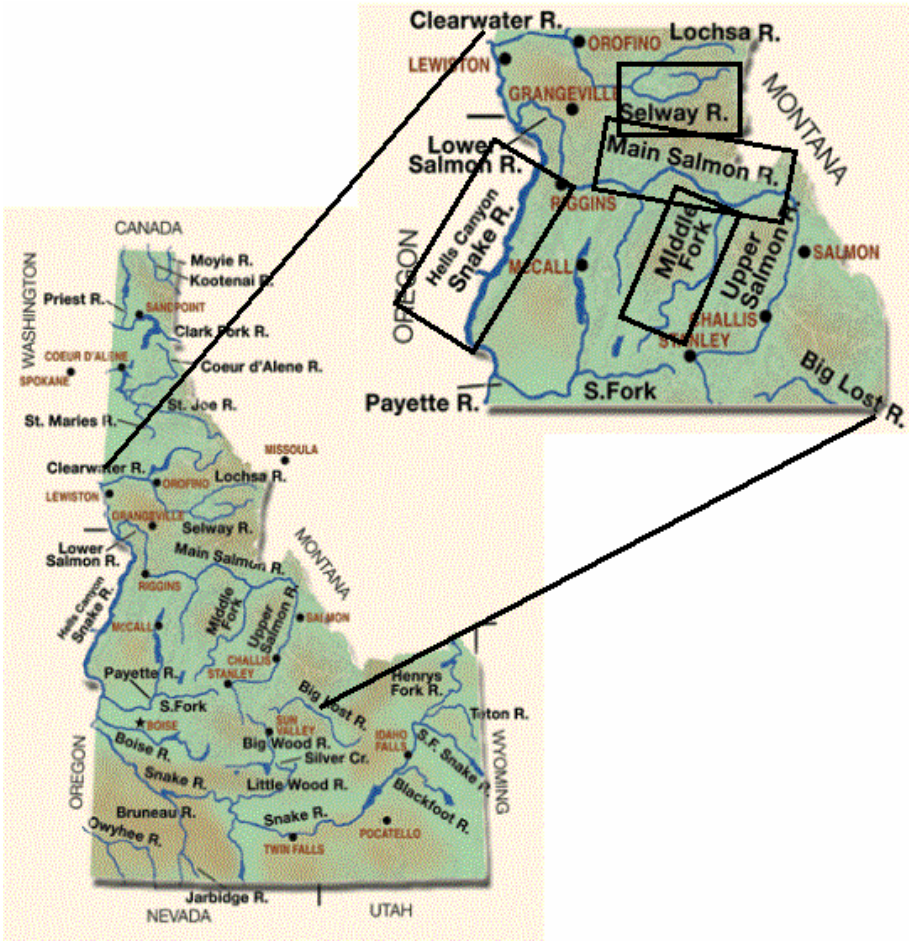

Figure 1: Idaho and the 4 stretches of river under the 4 Rivers Lottery.
Source: http://www.ioga.org/riverssearch.htm

[4] These raft trips include various services provided by the outfitters, so this market price is not strictly related to the willingness to pay for a private permit.

In their bid to win a permit in the private (noncommercial) lottery, rafters submit an application that may list up to four choices ranked for specific rivers and dates, along with a $6 application fee. After the January 31 deadline, a random drawing for applicant's names occurs. When a name is drawn, the applicant is issued a permit for their first choice river and date if it is available. If the first choice is not available, review of the remaining choices occurs until a permit is issued or all four choices are determined to be unavailable. Random drawings occur until the full quota of permits are issued (Martin, U.S. Department of Agriculture). This permit allocation system was instituted in 1987, in response to high demand replacing various allocation systems for these stretches of river (Martin). Today, much more so than a couple of decades ago, demand for permits far outweighs permit availability: 15,357 applications were submitted for the 1076 permits allotted for the 2003 season. This equates to an average 7% chance of obtaining a permit. Table 1 contains summary statistics for the Four Rivers Lottery for the 2000-2002 seasons. Clearly, given the cost of a raft trip, more rafters positively value rafting permits than are available.

Table 1. Numbers of applications submitted and permits allocated for the Four Rivers Lottery, average for 2000-2002.

	Submitted	*Allotted*	*%*
Main Salmon	2,646	285	10.8
Middle Fork Salmon	9,508	351	3.7
Hell's Canyon, Snake	807	327	40.5
Selway	1,755	62	3.5
Total	**14,715**	**1,025**	**7.0**

Source: http://www.fs.fed.us/r4/sc/recreation/4rivers/stats.htm

Why Might the Forest Service have a lottery and Prohibit a Secondary Market?

Loomis (1980) compares the level of efficiency under a pricing versus a lottery allocation method for permits in Westwater Canyon of the Colorado River, and concludes that a pricing mechanism would provide the greatest efficiency but is less equitable than a lottery. Nonetheless, the idea that everyone should have equal access to government-regulated resources has been a part of the recreation culture for at least the last century, and the objectives of the Forest Service (as molded in part by the interests of stakeholders) clearly play a role in the allocation process used for the four rivers permits. The use of lotteries for allocating resources is one way to minimize the perception that some receive preferential treatment or easier access than others.

We hypothesize further that the Forest Service intends to direct the rents associated with rafting permits to the users of the resource services themselves. By prohibiting a post-lottery market for permits, nonrafters have no incentive to apply for a permit, and rafters are protected from losing a portion of the rents from the resource to profit-seeking nonrafters. Rafters are an interest group concentrated on this specific type of resource (of which these rivers are an important and unique component), and are likely to have a great deal of influence on the managers of the permit system (Becker).

Expected benefits with and without a post-lottery permit market

To shed light on the economic effects of a post-lottery market restriction, we compare the expected value of rafting permits to rafters under three scenarios: 1) the status quo, in which no secondary market is allowed, 2) a scenario in which only "rafters" are allowed to apply to win a permit by lottery but are then allowed to buy and sell permits afterward, and 3) a scenario in which anyone, including nonrafters, may apply to win a permit by lottery, and a post-lottery market for permits is allowed.

In any of these cases, the demand for permits by rafters underlies the equilibrium characteristics of both the lottery and market. We define *rafters* as individuals that place a positive value on a rafting permit --- that is, the set of individuals for whom demand is positive. Think of rafters as being arranged in descending order of their valuation and, once our duckies are in a row, their valuations can be represented by a continuous, linear, downward sloping demand curve.[5] As Rumy and Hanke observe, in a simple market for permits (with no lottery involved), rafters would pay up to the net expected value of the rafting trip to obtain a permit to allow them to go rafting. Therefore, the expected value of the permit itself is a direct reflection of the net value of rafting.

The permit allocation process can be divided into two steps, the application step, and the redistribution step. For the no-market alternative, the second step is disallowed. With a market, the second step involves trading between some lottery winners and would-be rafters. People will only apply for a permit if their expected benefit of doing so outweighs the cost of applying. This expectation is the probability of winning times the value of the permit to the winner, and the scenario that applicants face affects both of these elements. Assuming a simultaneous random draw for each available permit, the probability of winning is the number of allocated permits divided by the number of applications. The value of the permit to the applicant is either the net value of a rafting trip or the expected market price for permits, whichever is greatest.

For the analysis below we assume that the total cost of applying is the application fee. Further, if a market is allowed, the market price of a permit will be equal to the marginal permit valuation for the marginal permit issued; that is, we assume a competitive market, and all transferred permits will be bought and sold at the market price. In Figure 2, $\overline{p}$ is the market price given total allocated permits $\overline{q}$.

The Permit Lottery with no Secondary Market

Permit winners are chosen randomly from all applicants, and so with a secondary market prohibited, the expected aggregate value of the permits to rafters is the sum of the expected value for all applicants, represented by area B+C+D+E in Figure 2 minus the sum of the application fees. There are two important consequences of the market restriction: 1) some of the nonwinners may value a permit more than some of the permit winners, and both permit winners and losers could be better off if trade between these rafters was allowed; 2) because nonrafters (by definition) would not want to use the permit themselves and are prohibited from selling them, no nonrafters will enter the lottery given the market prohibition.

Rafter-Only Lottery with a Secondary Market

Suppose, however, that only rafters (people who like rafting) are allowed to apply for the lottery. The expected benefit of an application for a rafter in this setting is the maximum of the market price and the rafters individual permit value, times the probability of winning. The cost of an application is still the application fee, and the individual will apply if the expected benefit is larger than the application cost. The market price will induce some half-hearted rafters to apply for a permit just to sell it, so there will be

[5] A "duckie" is common name for a one-person raft.

more applicants. However, with more applicants, the probability of winning will decrease. The marginal applicant will be that person for whom the expected value of obtaining a permit (market price times the probability of winning) equals the application cost.

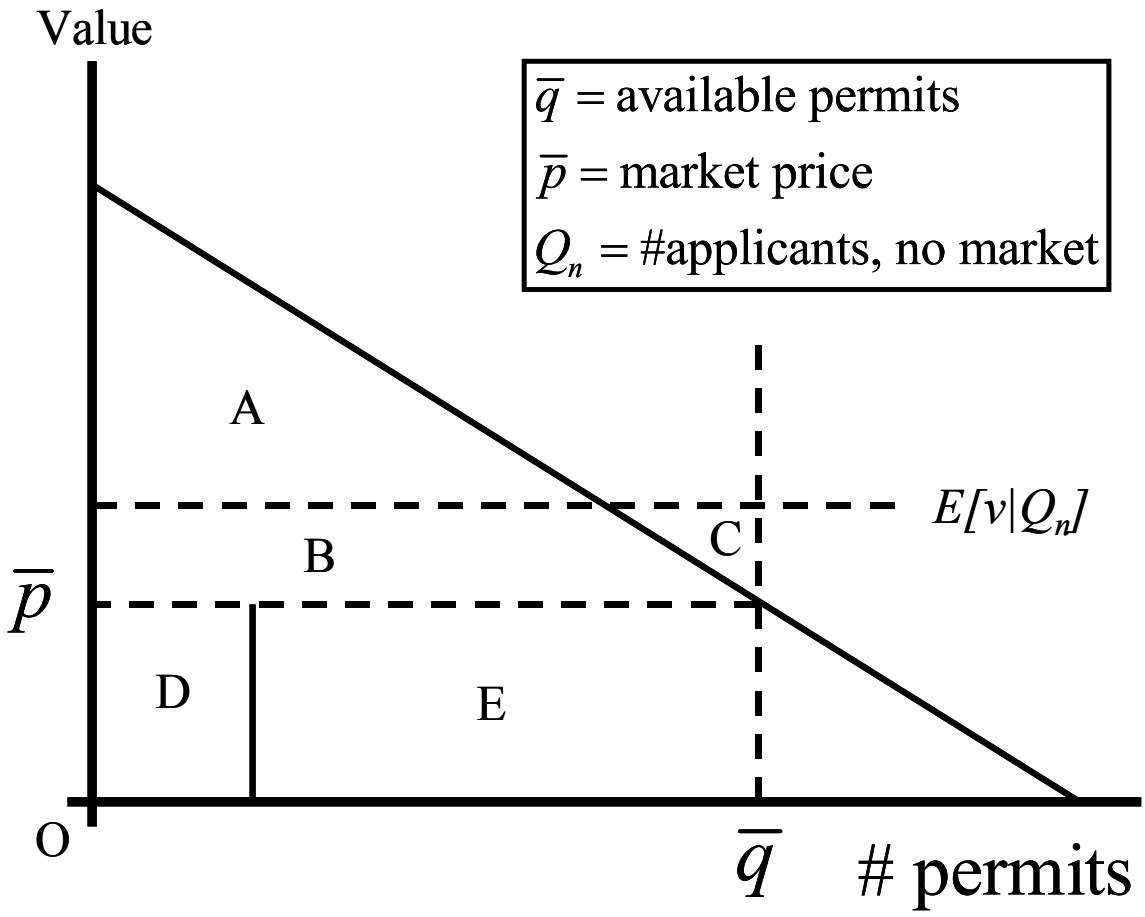

Figure 2: Benefits from a random lottery are (B+C+D+E), a rafter-only lottery with market (A+B+D+E), and an open lottery with market (A+B+D). Area *E* is equivalent the value lost to non-rafters in an open lottery and market, given that E/(D+E) is the fraction of applicants who are nonrafters. The lottery with no market outperforms an open market from rafters' perspective if C+E-application fees > A- non-rafter application fees. This graph does not account for application fees.

Because rafters now have the ability to sell to other rafters in a secondary market, the value of a permit to a rafter will be the greater of the market price or the individual's willingness to pay for the right to take a raft trip. With the rafter-only secondary market, zealous lottery losers will buy permits from half-hearted winners. The value of the traded permits is maximized because the highest valued users ultimately use them, and all the value of the right to take a trip is accrued by rafters. Winners who choose to use the permit rather than sell them receive the same surplus as under the lottery-only scenario. The aggregate benefit of permits in the rafter-only market in Figure 2 is A+B+D+E. This total aggregate value will be higher with the secondary market than without, and all of it is accrued by rafters because the lottery is restricted to rafters only.

An Open Permit Lottery with a Secondary Market

If application for a permit is not restricted to rafters and permit trading is allowed after the lottery, the market price might induce nonrafters to apply for a permit for the sole purpose of selling it (just as a rafter-only market might induce half-hearted rafters to apply and sell). In this open lottery case, an individual's permit value is still the maximum of the value they place on a raft trip or the price they can receive in the market. The market price of a permit will be the same with either type of secondary market ($\overline{p}$ in Figure 1). Nonrafters will apply if the expected value of an application (the market price times the probability of winning a permit) is greater than the application fee.

With an open secondary market, the aggregate value of permits to rafters will be less than in the rafter-only lottery with a secondary market. Rafters will be less likely to win a permit because nonrafters also submit applications, and some of the rafter surplus will be transferred from rafters to nonrafters. This loss is equal to the market price times the number of winning nonrafters, and is equivalent to area E in Figure 2 given that the fraction of winners who are nonrafters is equal to E/(D+E). With this transfer of welfare to nonrafters, the total aggregate value of permits to rafters is less with the open secondary market than under a rafter-only lottery with market.

The comparison between an open lottery and market and the current lottery for nontransferable permits is very interesting. The aggregate value of permits to rafters in the open secondary market may be higher or lower than in the lottery market with no secondary market (which, remember, is the current policy). The upside of allowing a secondary market was discussed above: rafters who win can sell to other rafters if the price is right, and rafters are therefore better off. The downside is that nonrafters enter and extract some of the rents embodied in the market price of permits. Considering Figure 2 again, the lottery with no secondary market outperforms the open market only if C+E – (total application fees) is greater than A – (application fees paid by rafters). Which of these amounts outweighs the other is an empirical question that depends in large part on how many nonrafters are induced to apply in the initial lottery. This fraction in turn depends on the size of application fee charged, the number of permits allotted, and the shape of the demand curve.

Conclusions

From the perspective of the resource users --- rafters in this case --- allowing a post-lottery market for permit trading is a double-edged sword. Although such a market would allow rafters to trade permits among themselves and improve the aggregate value of river use to this stakeholder group as a whole, it also puts them in a position where they are less likely to win a permit in the initial lottery, and more likely to have to pay an individual to be able to raft these rivers --- someone who never had any intention of rafting in the first place, no less. Although it is true that with a secondary market rafters will transfer some amount of surplus to nonrafters, it remains unclear whether rafters are better off with a market prohibition.

Nonetheless, the lottery managers have at least two instruments that would affect the incentives to apply for permits: the application fee and the number of allotted permits. Changing the levels of these two policy instruments may change the share of applications, and therefore permits, that go to nonrafters, but using these instruments in such a way will have other ramifications for the distribution of user-group welfare as well. For example, higher lottery application fees or post-win permit charges could also be applied to through the Recreational Fee Demonstration Program for maintaining these beautiful river environments, which face substantial pressure almost entirely from rafters. It remains to be seen if a market mechanism can be developed, even in theory, which might make use of the market in a politically expedient way.

There are a couple of reasons to think that a post-lottery market for rafters is more than just a useful hypothetical for understanding the losses to rafters associated with a rafter-only lottery. First, if the goal were to allow a secondary market while restricting that market primarily to rafters, there may be ways to do so, at least to some extent. For example, to be eligible to receive a permit for rafting the Grand Canyon, individuals are required to show some evidence of experience on comparable rivers. Although this requirement is ostensibly implemented for safety reasons, evidence of experience is also evidence of prior interest, and so could be interpreted as a signal that the individual is really a part of the "rafting community". Second, a lottery in Kansas has been designed explicitly for transfer of deer permits. Fifty percent of all nonresident deer permits are set aside for a lottery for landowners, who then may sell these permits to hunters (Taylor and Marsh). This case is particularly interesting not because of the similarities with rafting permits, but because of a big difference. Kansas landowners are easily distinguishable from non-Kansas landowners (or Kansas nonlandowners).[6] If river rats were as easily flushed out, perhaps a post-lottery market would have been implemented by now.

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[6] Taylor and Marsh (2003) find evidence, however, that hunting outfitters appear to be capturing a substantial amount of the rents form the transferable permits.

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